FARMING OF COBIA AND SILVER POMPANO

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INTRODUCTION

Mariculture can be defined as the controlled cultivation and harvest of aquatic organisms, including finfish, shellfish, and aquatic plants. Mariculture operations are conducted at both land and water facilities. Land-based mariculture systems include ponds, tanks, raceways, and water flow-through and recirculating systems. Water-based mariculture systems include net pens, cages, ocean ranching, longline culture, and bottom culture. Mariculture can provide a number of socio-economic benefits, including food provision, improved nutrition and health, generation of income and employment, diversification of primary products, and increased trade earnings through the export of high-value products. Aquaculture can also provide environmental benefits by supporting stocking and release of hatchery-reared organisms, countering nutrient and organic enrichment in eutrophic waters from the culture of some mollusk and seaweed species, and because aquaculture operations relies on good water quality, the prevention and control of aquatic pollution.

Cage farming

Commercially important marine fishes can be cultured in any of the four culture systems like ponds, raceways, recirculation systems or cages. In the simplest term, a cage is an enclosure in the water body whereby the juveniles of aquatic animals are kept, fed and grown to a marketable size. Cage culture uses existing water resources (ponds, rivers, estuaries, open ocean, etc.) but confines the fish inside some type of mesh enclosure. The mesh retains the fish, making it easier to feed, observe and harvest them. The mesh also allows the water to pass freely between the fish and surrounding water resource, thus maintaining good water quality by removing wastes. In recent years, cage culture has emerged as the most viable method of sea farming.

Cage culture probably originated with fishermen who used cages to accumulate fish for market. Over time, they learned to feed the fish in these cages to increase their size and improve their overall health. The first cages used for just holding fish were probably developed in Southeast Asia at the end of the 18th century. These cages were constructed of wood or bamboo and the confined fish were fed trash fish and food scraps. Modern cage culture in the U.S. began in the 1950s with the advent of synthetic materials suitable for cage construction. There has been little research on marine cage systems because of regulatory issues, a limited number of good quality sites and high cost of research. In freshwater sector, cage culture allows farmers to use existing water resources that may or may not be used for other purposes. The fish produced are usually sold to local niche markets. As wild-capture fisheries have declined and aquaculture has expanded, these niche markets have also grown. As a result to cater the demand more entrepreneurial opportunities have grown for cage farming. The cage culture was initiated in Norway during 70s and developed into an organised industry, particularly for salmon farming. Similarly the cage culture has spread in South East Asian countries for culture of a variety of

fishes. The major advantage in these countries is that they have large, calm and protected bays to accommodate the cages safely against natural bad weather conditions.

Advantages of Cage Culture

1. **Effective use of Resources**
   Cage culture can be established in any suitable body of water, including open seas, backwaters, lagoons or river mouths with proper water quality, seed, feeding strategies, access and permission from local authorities. This flexibility makes it possible to exploit underused water resources to produce fish.
2. **Low investment**
   The investment for pond construction and its associated infrastructure (electricity, roads, water wells, etc.) are much higher than the cage farming, which is practiced in an existing water body and can be less expensive. At low densities (when compared to pond water spread area) cages placed in open seas, backwater and lagoons do not require aeration. Cage materials are not much expensive and can be mended with little experience.
3. **Simple farming operations**
   In cage farming, observation of the growth and health status of the fish is easy and simple. The observation of fish behaviour, especially feeding behaviour, is critical in avoiding problems related to stress and disease outbreak.
4. **Easy harvesting methods**
   Cages are usually harvested by moving them into shallow water, crowding the fish into a corner of the net. Otherwise, the cage net can be lifted partially out of the water so that the fish are crowded into a smaller volume, and then it can be harvested. This makes it possible to partially harvest fish from cages as and when needed for local markets.
5. **Multi-use of water resources**
   The confinement of fish in cages will not affect other uses of the water resource, such as fishing, boating, swimming, irrigation or livestock watering.
   Cage farming requires low capital investment and the farmer can expand production with additional cages or intensify production by increasing the stocking density at an optimal level.

Species selection

Cage culture in open seas requires a fish variety with the basic characters like, suitability for marketing, commercial importance, consumer accepted fish, easy to culture, adaptability to the cage environment, acceptance to artificial diets, faster growth rate and resistant to common diseases.

A variety of commercially important marine fishes including, Cobia *Rachycentron canadum*), Seabass (*Lates calcarifer*), Snappers (*Lutjanus* sp.), Carangids (*Trachinotus* sp.) and Groupers (*Epinephelus* sp.) and lobsters are highly suitable for cage farming. Commercial level seed production technology for majority of these fishes has been developed in many of the South East Asian countries.

Cobia (*Rachycentron canadum*)

Cobia has gained popularity as a good candidate for mariculture due to its rapid growth and white meat of versatile use. It is considered as one of the most promising candidates for warm-water marine fish aquaculture in the world. Being the only member of the family Rachycentridae, it is found in the warm, temperate to tropical waters of the West and East Atlantic, throughout the Caribbean and in the Indo-Pacific off India, Australia and Japan. To date, research and development of cobia aquaculture has been initiated in over 23 countries and territories, half of them in the Asian-Pacific region. Statistics of FAO (2009) show that the

global aquaculture production of cobia has been increasing rapidly from only 9 tonnes in 1997 to nearly 30,000 tonnes in 2007. Since late 1990, cobia aquaculture production has been steadily expanding in Asia, primarily in Taiwan, Vietnam and China, but also in other Southeast and Indo-Pacific Asian countries including the Philippines, Indonesia, Iran and Reunion Island. Although cobia production is expanding rapidly, combined production of Asian countries is still rather lower.

Cobia farming techniques developed by CMFRI

India is late starter in cobia research and the seed production of cobia was achieved for first time in India by the Mandapam Regional Centre of Central Marine Fisheries Research Institute (CMFRI). Later the farming protocols in the High Density Polyethylene (HDPE) cages and Galvanized Iron (GI) cages with different feeding strategies were developed, tested and validated. Out of this farming trials an economically viable farming methods has been evolved. These farming methods have been executed in a participatory farming demonstration with M/s. Vitality Aquaculture Pvt. Ltd., Tuticorin and successful harvest of cobia was made during May 2013 in the presence of the Director General, ICAR, New Delhi.

The basic protocols followed for cage culture of cobia in different phases are narrated as below:-

Nursery Phase 1

The 4 weeks old fingerlings were reared for 6 weeks indoor (Nursery Phase 1) followed by 8 weeks outdoor (Nursery Phase 2) before stocking in grow-out cages. The nursery phase 1 can be carried out in FRP tanks of 7 ton capacity with 5 ton filtered sea water. The stocking density has to be kept as 8 nos. per litre. The fingerlings have to be fed with INVE (Thailand) formulated diet (assorted size from 400 µ to 1200 µ) thrice daily. The weaning to chopped low-value fishes can be practised during the last week of this phase. The water exchange has to be done 100% daily.

Nursery Phase 2

The nursery phase 2 has to be carried out in specially designed sea cages. These nursery cages should be made of HDPE pipes or GI Pipe (C - Class type) material. The dimension of the square sea cage has to be kept as 4x4 meter with the handrail fixed at one meter height from the base otherwise a circular cage of 6 meter dia can be used. The net cages fabricated with HDPE ropes of 2.5 mm thickness and the mesh size has to be used are 20 mm for inner net cage and 40 mm for outer net cage. The depth of the net cage shall be kept 3 meters from the base. The shape of the net cages has to be maintained with ballast. The buoyancy of the cages can be enabled by tying HDPE drums with the cage frame and has to be moored with two numbers of Galvanized Iron (GI) anchors of 70/100 kg each in opposite directions.

The fingerlings from nursery phase 1 have to be transferred to these floating nursery sea cages. The stocking density biomass at this phase can be maintained at 1.8-3.0 kg/m^3. The fingerlings have to be fed @ 5% total biomass of fish with chopped low-value fishes (Sardine, lesser sardine, rainbow sardine, etc.) twice daily. Net cages have to be changed based on the subjective assessment of clogging of the net in order to have sufficient water exchange. Random sampling has to be carried out weekly with the sample size of 30 nos. per cage. This phase can be continued for about 4 weeks.

Grow-out Phase

The grow-out culture has to be carried out in circular floating sea cages of 6 meter diameter. The cage frames should be made up of HDPE pipes or GI pipes. The handrail has to be fixed at half meter height form the base. The space between inner and outer rings of the cage has to be

kept as one meter. The net cages fabricated with HDPE ropes of 2.5 mm thickness and the mesh size of 40 mm for inner net cage and 60 mm for outer net cage has to be used. The depth of the net cages should be maintained at 4.0 meters from the base. The shape of the net cages can be maintained with circular ballast. The cages were floated and moored as mentioned in Nursery Phase 2.

The juveniles from nursery phase 2 have to be transferred to these grow-out sea cages. The stocking density at this phase has to be maintained at 3.0-5.0 kg/m^3 or 750 no.s of juvenile cobia per cage. The juveniles can be fed @ 5% total biomass of fish with chopped low-value fishes (sardine, lesser sardine, rainbow sardine, etc.) once daily. Net cages have to be changed based on the subjective assessment of fouling of the net in order to have sufficient water exchange. Random sampling has to be carried out at monthly intervals with the sample size of 30 nos. per cage. The entire grow-out culture can be carried out for a period of 6- 7 months.

Performance

The fingerlings stocked in indoor nursery at around 2 grams and will attain an average weight of 45 grams in 6 weeks, followed and about 70 grams in another 4 weeks of outdoor nursery rearing. The juveniles would reach an average weight of 1.0 kg in 4 months and 2.5 – 3.0 kg in 6- 7 months of grow-out culture in sea cages. The grow-out fishes would reach an average weight of 7.0 kg with a maximum weight of 8.0 kg within the culture period of one year which is almost 100 times the growth of the initial weight.

The unit cost estimate, performance of production and economics of operation gained through the farming trials and participatory demonstration were worked out and given below:-

ECONOMICS OF OPEN SEA CAGE FARMING IN A 6 METER DIA HDPE CAGE

Sl. No.	Head of expense	Cost in INR (in lakh)
Capital Expenditure		
	Cage and Net	
1	Cost of Cage (6 meter dia.) made of HDPE material	1.50
2	Cost of netting (4 m depth) for one outer net, two inner nets, one bird net cages and mooring materials ballast hose, anchor and anchor rope	1.00
	Sub Total	**2.50**
Operational Expenditure		
1	Cost of 900 Numbers of cobia seeds @ 8 fingerlings / m^3 @ INR 30/seed (Total volume of a cage: 113.04 m^3)	0.27
2	Transportation	0.10
3	Cost of 5.10 tonnes of Extruded pellet feed @ FCR 1:1.8 @ INR 0.75 lakh / tonne	3.83
4	Labour Charges @ INR 8000/ Person/month X 7 months	0.56
5	Boat Hire & Fuel Charges	0.50
6	Miscellaneous expenses	0.50
	Sub Total	**5.76**
	Grand Total	**8.26**

Sl. No	Production Estimate and Economics
1	Survival 90% = 810 fishes
2	Feed Conversion Ratio = 1 : 2
3	Average size of each fish at the time of harvest =3.5 kg
4	Total harvest = 2,835 kgs/cage (2.835 tonnes/cage)
5	Sale price of the produce @ INR 310/kg = INR 8.79 lakh
6	Gross Income from the harvest = INR 8.79 lakh
7	Gross income – Operational expenses = INR 3.03 lakh
8	Gross Profit = INR 3.03 lakh

Pond Farming of finfishes

Among the many high value marine tropical finfish that could be farmed in India, the silver pompano, *Trachinotus blochii* is one of the topmost, mainly due to its fast growth rate, good meat quality and high market demand. The silver pompano is caught only sporadically in the commercial fishery and hence its availability is rather scarce. It is a much sought after species and hence the demand can only be met through aquaculture. The aquaculture of pompano has been successfully established in many Asia-Pacific countries like Taiwan and Indonesia. The farming can be successfully carried out in ponds, tanks and floating sea cages. The species is pelagic, very active and is able to acclimatize and grow well even at a lower salinity of about 10 ppt and hence is suitable for farming in the vast low saline waters of our country besides its potential for sea cage farming. The shape, colouration and meat quality of this fish is comparable with silver pomfret. In the international market, the dockside price of Florida pompano averaged to $ 8 /kg and in India, the current price of silver pompano is about Rs.200/- per kg at the fish landing centres and around Rs. 250/- per kg in the retail markets.

The Central Marine Fisheries Research Institute has initiated aquaculture research on pompano from 2008 and the first successful broodstock development, induced breeding and larval production was achieved in 2011. Following the successful seed production of Silver Pompano, demonstration of farming in brackishwater ponds was initiated by the CMFRI to popularize among the farmers about its suitability for aquaculture. The first farming demonstration from the hatchery produced seed was carried out in a coastal aquaculture pond at Anthervedi Village, East Godavari District, Andhra Pradesh. It has been proven that Silver pompano can be cultured in the brackish water shrimp culture ponds as an alternative species with high survival rate, appreciable FCR and meat quality. These fishes have attained an average weight of 450 grams in 240 days (8 months).

Based on the experience gained on the brackishwater farming of silver pompano, the practices to be adopted for pompano farming are narrated as follows:-

Pond Preparation

The pond has to be dried properly until the cracks appear on the surface. The top layer of the soil containing waste accumulated through previous crop of fish or shrimp has to be removed. Ploughing has to be done to tilt the soil below 30 cm. Feeding areas, corners and side ditches in the pond has to be properly tiled and dried to avoid formation of black soil. The average water pH of 7.5-8.5 would be ideal for pompano farming. The level of lime application during pond

preparation depends on the pH of the soil. Hence, the dosage has to be calculated accordingly. Water filling has to be initiated by covering the inlet pipe by using 2 layers of fine nets (100 micron) to avoid introducing other fishes and predators. A week before stocking, the pond must be fertilized with either organic or inorganic fertilizers to stimulate the plankton bloom.

Salinity

Pompano can tolerate vide range of salinities from 5- 40 ppt. However, ideal salinity for farming would be between 15 – 25 ppt. Pond has to be filled with a minimum water level of 100 cm prior to stocking of fish seeds. During the entire culture period 1.5 meter water depth has to be maintained.

Nursery Rearing and Seed Stocking

Hatchery produced pompano fingerlings of 1 inch size can be stocked in happas/ pens of 2 meter length, 2.0 meter width and 1.5 meter depth. In each happa about 200 fingerlings can be stocked. While stocking care should be taken to avoid agitation of the pond bottom and too many persons getting into the pond may increase the suspended solid load in the water, which may cause gill chocking of the fish fingerlings leading to mortality. Initially the fishes have to be reared in happas for 60 days or until they attain 10 – 15 grams size and thereafter it can be released into the pond. The mesh size of the happa could be initially at 4 mm size and it can be changed with 8mm mesh size happas after 30 days. The stocking density in happa could be maintained as 200 nos/ happa. After attaining 30 grams size ideally 5,000 Nos. can be stocked in a one acre pond.

Adult Pompano

Pompano Fingerlings (1.5 inch size)

First Supply of Pompano to a farmer

Happa Rearing

Pond Culture of pompano

Feeding with Extruded Floating Pellet feed

Sampling of Pompano

Harvested Pompano

Nutritional Requirement & Feeding

Pompano is a fast moving marine fish and it requires highly nutritive feed to meet the energy requirements. During nursery rearing Pompano can be weaned to any type of feeds viz., extruded floating pellet, sinking pellet feed and chopped trash fishes. Ideally pompano can be weaned to extruded floating pellet feed to avoid feed wastage and spoilage of pond bottom. The CMFRI has conducted pompano farming demonstration by using the extruded floating pellet feed manufactured by M/s. Rudhra Techno Feeds, Bhimavaram, Andhra Pradesh. During the happa rearing phase, feeding has to be done 4 times a day and in pond culture phase it could be 3 times a day. The feed size should be lesser than the mouth size of the fish and hence, suitable sized feed has to be selected for feeding the fishes. The details of feed and feeding schedule of pompano are as follows:-

Weight of the fish	Feed Size	Crude Protein %	Crude Fat %	% to be fed as per the biomass	Feeding / day
> 1 Gram	800 - 1000 µ	50	12-15	30	4
1 – 10 gram	1.0 - 1.5mm	48	12	20	4
10 – 100 gram	1.8 mm	45	10	8	3
100 – 250 gram	3.5 mm	42	12	5	3
250 – 500 gram	4.5 mm	40	12	3	3

A mix of two sizes of feed pellet can be used if there is any size variation of the fishes found during the regular sampling. If sinking pellet feed is used, at least 4 – 8 feed trays (80 cm x 80 cm) per pond could be placed. Regular sampling of fishes once in 15 days has to be carried out to determine growth rate and to calculate the FCR. In the first farming demonstration, FCR was 1: 1.8 with the above formulations.

Water Quality Management

Plankton bloom is essential for early stages of pompano (until 100 grams) culture. If the color of the pond water is clear a mixture of organic (10-30 kg./ha.) and inorganic fertilizers (1-3 kg./ha.) can be applied to obtain algal bloom. Sufficient water level must be maintained in the ponds to reduce risks of the growth of benthic algae. The water depth in the shallowest part of the pond should be at least 100 cm. Water quality can be maintained by exchanging 10% of the water once in a week; 20% per week after 3 months and 30% per week after 6 months. If water colour is too dark, the quantum of water exchange can be proportionately increased. To maintain water pH within an optimum range of 7.5 - 8.5, agri-lime has to be applied regularly. Dissolved oxygen (D.O) level should be maintained above 5 ppm at all times. Paddle wheel aerators can be placed in the pond to create minor water current and to maintain the DO level. Aeration is a must during late evening to early morning period when the fishes attains 200 grams size and above.

Growth Pattern

DOC	Growth (mm)	Weight (g)
1	30.59 ± 0.24	2.00 ± 0.04
30	73.42 ± 0.53	15.08 ± 0.16
60	102.88 ± 1.91	34.60 ± 0.41
90	158.39 ± 2.42	72.54 ± 1.95
120	182.30 ± 2.03	101.82 ± 3.11
150	203.71 ± 3.73	172.39 ± 4.55
180	226.51 ± 2.90	258.31 ± 5.76
210	273.07 ± 3.62	375.32 ± 8.07
240	296.88 ± 6.27	464.65 ± 10.25

During the entire culture period the growth pattern of pompano was monitored through regular sampling of fishes at fortnightly intervals. The length and weight measurements taken is presented as below:-

Health Management

Pompano is a much hardier species and does not get much disease problems. When it is reared in high salinities parasitic infection of copepods may occur. Periodical application of commercially available pond management chemicals like Iodine solution would help to keep the fishes healthier. Feed supplements like LIV- 52 syrup can be given by mixing with the feed to improve the immunity levels.

Harvesting

Harvesting of pompano could be carried out by using drag net as in the case of fresh water fishes. To maintain the freshness and quality of harvested fish, washing in clean water and chill killing can be done. Harvested fishes can be stocked in plastic crates by adding layers of ice in equal quantities at the bottom and top of the fish. It is suggested that harvesting of fish can be carried out during the off season period of April to June to get a better price.

It is well recognized that for sustainable production in aquaculture, diversification of species is a vital requirement and from the lessons learnt from the shrimp farming scenario in India, it is very much needed to diversify the marine and brackish water aquaculture with high value fin

fish species. Generally, high value marine fishes are in good demand in the Indian market and often there is a scarcity of the same. In the domestic market, silver pompano has demand starting from 250 grams size onwards. Hence, it is felt that pompano aquaculture can prove to be much lucrative and can emerge as a major aquaculture enterprise in the coming years.

HDPE Cage (6 meter Dia)

GI Pipe Cage (6 meter Dia)

Cobia fingerlings (50 days old)

Cobia juveniles (While feeding)

Cobia Juveniles (3 Kg size)

Harvested Cobia